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ABSTRACT

This study determined the effects of using an instructional game and supplemental readings on student motivation as defined using the ARCS model of motivation and performance. Subjects were 75 undergraduate education majors enrolled in a required educational psychology course at a large southwestern university. All students attended a lecture on the information processing model of learning and were told to read a chapter in the textbook, "Essentials of Learning for Instruction," by Gagne and Driscoll. Two days later, subjects were randomly assigned to either a treatment group or a control group. Both groups were given 30 minutes to practice the information presented in the lecture and assigned reading. Treatment group subjects used an instructional game developed by the researchers, and subjects in the control group used a worksheet containing the same review questions as the game. Upon completion of the practice activity, all subjects completed the Instructional Materials Motivation Scale (IMMS) and then took a 15-item constructed response posttest to measure their performance. Multivariate analysis was used to test for an overall difference between groups on the motivation scales. This was followed by univariate analysis on each of the four IMMS subscales. Results indicate that using the instructional game and completing the reading assignment both had a significant effect on motivation, and that completion of the reading assignment significantly contributed to posttest performance. While results suggest that subjects in the treatment condition outperformed control group subjects on the posttest, this difference was not statistically significant. These results suggest that instructional designers can provide students with a motivating practice alternative that is as effective as more traditional methods of practice. (39 references) (GL)

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Providing Practice using Instructional Gaming: A Motivating Alternative

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Providing Practice using Instructional Gaming: A Motivating Alternative

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Providing students with an opportunity to practice newly acquired skills and knowledge is an important component in designing an instructional strategy. While many instructional design theories include recommendations for designing practice activities, Salisbury, Richards, and Klein (1985) point out that most of these theories fail to address how to design practice that is motivational.

A number of educators argue that instructional games are effective for providing motivating practice of newly acquired skills and information. These scholars argue that instructional games are motivational because they generate enthusiasm, excitement, and enjoyment and because they require students to be actively involved in learning (Coleman, 1968; Ernest, 1986; Rakes & Kutzman, 1982; Wesson, Wilson, & Mandlebaum, 1988). Other scholars argue that instructional games decrease student motivation. These authors believe that the motivational aspects of instructional games are limited to those who win, and that losing an instructional game produces a failure syndrome and reduces self esteem (Allington & Strange, 1977; Andrews & Thorpe, 1977).

While theorists argue about the motivational aspects of instructional games, researchers have investigated the effect of using games on student motivation. The results of these studies are inconclusive. Some researchers report that the use of instructional gaming increases student interest, satisfaction, and continuing motivation (Devries & Edwards, 1973; Sleet, 1985; Straus, 1986). Others report that playing a game does not influence student satisfaction or attitude toward school (Devries & Slavin, 1978). Investigators also report that instructional games influence school attendance. Allen and Main (1976) found that including instructional gaming in a mathematics curriculum helped to reduce the rate of absenteeism of students in inner-city schools. Studies by Raia (1966) and Boseman and Schellenberger (1974) indicated that including games in a college business course has a positive affect on course attendance but not on expressed interest and satisfaction.

In addition to the possible motivational benefits instructional games, educators believe that games are effective for helping students learn. Scholars argue that instructional games make practice more effective because students become active participants in the learning process (Ernest, 1986; Rakes & Kutzman, 1982; Wesson, Wilson, & Mandlebaum, 1988). Others argue that games foster incorrect responding, are an inefficient use of instructional time, and that the rate of practice in a game cannot compare to a flashcard drill or reading a connected text (Allington & Strange, 1977; Andrews & Thorpe, 1977).

Researchers have attempted to answer whether instructional games are an effective method for learning. The results of these studies are inconclusive. Some investigators report that instructional games are effective for assisting students to acquire, practice, and transfer mathematical concepts and problem solving abilities (Bright, 1980; Bright & Harvey, 1982; Bright, Harvey, & Wheeler, 1979; Devries & Slavin, 1978; Dienes, 1962; Rogers & Miller, 1984). Others report that using an instructional game to practice math skills assists slow learners but not more able students (Friedlander, 1977). Research on the use of instructional games in college business courses has produced inconclusive or nonsignificant finding in many studies (Boseman & Schellenberger, 1974; Greenlaw and Wyman, 1973; Raia, 1966), while instructional games have positively influenced learning in actual business training settings (Jacobs & Baum, 1987; Pierfy, 1977). Even advocates of instructional gaming believe that there is some disagreement over whether games teach intellectual content and skills (Boocock, 1968).

There are several explanations for the inconsistent findings from research concerning the effect of instructional games on motivation and learning. One is that much of the research on instructional gaming has been conducted using flawed experimental designs and methods (Reiser & Gerlach, 1977; Remus, 1981; Stone, 1982). Another explanation is that many of the studies on instructional gaming have not investigated the integration of games in an instructional system. Gaming advocates suggest that

games should be used with other instructional methods such as lecture and textbooks (Clayton & Rosenbloom, 1968). A third explanation is that researchers examining the effect of instructional gaming on motivation have not adequately defined and operationalized the variable of motivation. After an extensive review of instructional gaming, Wolfe (1985) indicated, "no rigorous research has examined a game's motivational power, [or] what types of students are motivated by games" (p.279).

The purpose of this paper is to describe the results of a study conducted to determine the effects of using an instructional game on student motivation and performance. Motivation was defined using the ARCS model of motivation (Keller, 1987a). This model suggests that motivation in an instructional setting consists of four components: attention, relevance, confidence, and satisfaction. We hypothesized that students using an instructional game to practice newly acquired information would indicate that this method enhanced their attention, relevance, confidence, and satisfaction. In addition, since the study was designed integrate the game into an instructional system, we attempted to determine the effect of using a supplemental reading on student motivation and performance.

Method

Subjects

Subjects were seventy-five undergraduate education majors at a large southwestern university. The students were enrolled in a

required course in educational psychology and participated in the study to satisfy a course requirement.

Materials

Materials used in this study were an instructional game and a worksheet, both designed to provide practice of information and concepts presented in a lecture, the textbook Essentials of Learning for Instruction by Gagne & Driscoll (1988), the Instructional Materials Motivation Scale (Keller, 1987b), and a measure of performance.

The instructional game was developed by the authors in order to provide subjects with practice on the information-processing model of learning. The instructional game consisted of a game board that graphically represented the information-processing model of learning, a direction card that explained the rules of the game, and a set of 25 game cards. Each game card had a practice question about the information-processing model of learning on the front and feedback with knowledge of correct results on the back.

The worksheet was also developed by the authors to provide subjects with practice on the information-processing model of learning. The worksheet was four pages in length and included the same 25 questions that appeared on the game cards. After subjects completed a set of five questions, the worksheet instructed subjects to turn to the last page for feedback.

The Instructional Materials Motivation Scale (IMMS), developed by Keller (1987b), was used to measure student

perception of the motivational characteristics of the instructional materials. The IMMS includes four subscales to measure the motivational components of attention, relevance, confidence, and satisfaction. Keller (1987b) reported that Cronbach's alpha reliability of this instrument is .89 for attention, .81 for relevance, .90 for confidence, .92 for satisfaction, and .96 for overall motivation.

A 15 item constructed response posttest was used to measure student performance. The items on this posttest were developed by the authors to determine subject mastery of the information-processing model. The internal consistency reliability of this measure was .77.

Procedures

All of the subjects attended a lecture on the information-processing model of learning and were told to read chapter two in the textbook Essentials of Learning for Instruction by Gagne & Driscoll (1988). Two days later, subjects were randomly assigned to either a treatment or control group. Subjects in both groups were given thirty minutes to practice the information presented in the lecture and assigned reading by using either the instructional game or the worksheet.

Treatment group subjects used the instructional game to practice the information-processing model. After being informed that they would be playing a game, subjects were randomly placed in groups of eight to ten and were asked to form two teams of players. Each group received the game materials described above

and the experimenter read the game rules aloud. Subjects were given thirty minutes to play the game.

Subjects in the control group used the worksheet to practice the same items. Each subject worked individually for thirty minutes to complete the worksheet. Subjects were told to review incorrect items if time permitted.

Upon completion of the practice activity, all subjects completed the Instructional Materials Motivation Scale and then took the posttest. Subjects were also asked if they had attended the lecture on the information-processing model and if they had completed the assigned reading from the textbook.

Results

Motivation

Multivariate analysis of variance (MANOVA) was used to test for an overall difference between groups on the motivation scales. An alpha level of .05 was set for the MANOVA tests. These analyses were followed by univariate analyses on each of the four IMMS subscales. In order to account for the possibility of inflated statistical error, alpha was set at .025 for the univariate analyses using the Bonferroni method (Stevens, 1986).

Results indicate that using the instructional game to practice information had a significant effect on motivation. A significant MANOVA effect, $F(4, 64) = 6.57$, $p < .001$ was found for the treatment on the motivation measures. Univariate analyses revealed that subjects who played the game rated this method of practice as motivational in the four areas of attention

$F(1, 67) = 21.91$, $p < .001$, relevance $F(1, 67) = 15.05$, $p < .001$, confidence $F(1, 67) = 16.80$, $p < .001$, and satisfaction $F(1, 67) = 24.71$, $p < .001$. Table 1 includes a summary of means and standard deviations on each motivation subscale for the game and the non-game groups.

Table 1 about here

Results also suggest that completion of reading assignment had an influence on motivation. A significant MANOVA effect, $F(4, 64) = 2.94$, $p < .05$, was found for this variable on the motivation measures. Follow-up univariate analyses revealed that the motivational area of confidence was significantly affected by completion of reading assignment $F(1, 67) = 6.52$, $p < .025$. Attention, relevance, and satisfaction were not significantly influenced by completion of reading assignment. Means and standard deviations can be found in Table 1.

Performance

Performance was measured using a 15 item constructed response posttest. Analysis of variance (ANOVA) was used to test for differences between groups on the performance measure. An alpha level of .05 was set for all statistical tests.

Results indicate that completion of assigned reading significantly contributed to posttest performance, $F(2, 72) = 14.87$, $p < .001$. Subjects who indicated that they had read the assigned materials significantly performed better on the posttest

that those who did not complete the reading (see Table 1). While results suggest that subjects in the treatment condition outperformed control group subjects on the posttest, this difference was not statistically significant.

Discussion

The major purpose of this study was to determine the effect of using an instructional game on student motivation and performance. The results of the study suggest that using an instructional game as a method of delivering practice does enhance the motivation of students in the four areas of attention, relevance, confidence, and satisfaction. However, the results show that an instructional game does not necessarily contribute to enhanced performance when it is used to practice information. These results occurred perhaps occurred for several reasons.

The instructional game used in this study provided students with a visual representation of the information-processing model of learning and required them to be active participants in the teaching/learning process. Keller (1987a) indicated that visual representations and active participation are two strategies that can increase student attention in an instructional setting. Furthermore, it is possible that using the game contributed to the results found for attention because of a novelty effect. Some researchers report that student motivation and interest fluctuate and decrease as the novelty effect of a game wears off (Dill, 1961; Greenlaw & Wyman 1973), while others report that

interest tends to persist over time in gaming settings (Dill & Doppelt, 1963). While novelty may be a reason for increased attention in this study, this explanation should be considered as positive by instructional designers who are concerned with providing motivating practice to students. Motivation and attention can be increased when variability and novelty are used in the classroom (Keller, 1983, 1987a).

The results found in this study for the motivational factor of relevance is consistent with theory proposed by gaming advocates. These authors argue that students will not question the relevance of educational content when it is presented via an instructional game (Abt, 1968; Rogers & Miller, 1984). In addition, Keller (1983) indicated that instructional designers can make instruction motivational by designing materials that are responsive to the needs of students. Orbach (1979) indicated that games are excellent methods to motivate students with a high need for achievement because a game can include an element of competition. Orbach (1979) also theorized that games can motivate students with a high need for affiliation when the game requires interaction among individuals and teams. The instructional game used in this study included a moderate level of competition and required students to interact through the team approach.

The instructional game used in this study also provided circumstances for student-directed learning. As a motivational strategy, student-centered learning has been linked with

increased confidence (Keller & Dodge, 1982). The finding that the game increased student confidence is consistent with theorists who suggest that games can influence student efficacy (Abt, 1968) and researchers who report that students rate the task of gaming as less difficult than other instructional techniques (Devries & Edwards, 1973).

The positive finding for satisfaction is also consistent with theory and research. A number of scholars indicate that instructional games contribute to motivation because they provide intrinsic reward and enjoyment (Coleman, 1968; Ernest, 1986; Rakes & Kutzman, 1982). Researchers report that instructional games lead to increases in student satisfaction (Devries & Edwards, 1973; Strauss, 1986). The results of this study support theorists and researchers who suggests that students enjoy the gaming approach in instruction.

While the results did suggest that instructional games have a strong effect on student motivation, the game used in this study did not have a significant impact on student performance. However, subjects completing an assigned reading significantly performed better and had more confidence about their performance than those who did not complete the reading. These results may have occurred due to the nature of the reading. Even though all the students were provided with necessary concepts and information in a lecture, the textbook Essentials of Learning for Instruction by Gagne & Driscoll (1988) provides readers with practice and feedback on the ideas presented in each chapter.

This additional practice and feedback more than likely influenced both the performance and confidence of those who completed the assigned reading.

The findings of this study have some implications for the design of practice. While many instructional design theorists indicate that students should be provided with an opportunity to practice newly acquired skills and knowledge, most fail to address how to design practice that is motivational (Salisbury, Richards, & Klein, 1985). The results of this study suggest that instructional designers can provide students with a motivating practice alternative that is as effective as more traditional methods of practice. Instructional designers should also include reading assignments that provide additional practice in their instructional strategies to increase student performance and confidence about that performance.

As was done in this study, future research should integrate instructional games into a system to determine if this method has an impact on educational outcomes. Besides using a game as practice, research could be conducted to examine the effect of using a game to present other instructional events such as stimulating recall of prior knowledge or as a review of learning. Researchers of instructional gaming should continue to investigate the effect of using a game on student motivation and should be specific in their operational definition of motivation. Implementation of these suggestions will assist us in determining how to design practice that is both effective and motivational.

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Table 1

Means and Standard Deviations on Attention (A) Relevance (R) Confidence (C) Satisfaction (S) and Performance (P) Measures

Group	A	R	C	S	P
Treatment					
Game n=37	4.22 (0.58)	3.71 (0.58)	4.06 (0.57)	3.88 (0.86)	10.49 (3.20)
Non Game n=38	3.77 (0.89)	3.13 (0.69)	3.31 (0.90)	2.72 (1.02)	9.39 (3.60)
Text Reading					
Read n=40	3.81 (0.65)	3.49 (0.57)	3.91 (0.67)	3.34 (0.89)	11.25 (3.07)
Not Read n=35	3.74 (0.84)	3.34 (0.68)	3.44 (0.61)	3.27 (0.99)	8.45 (3.22)

Note. Maximum scores = 5.00 for A, R, C, S and 15.00 for P.

Appendix 16

END

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